SBD and FBI Calibration

Goal: Use the IBEAM as a reference standard for all current measurements.

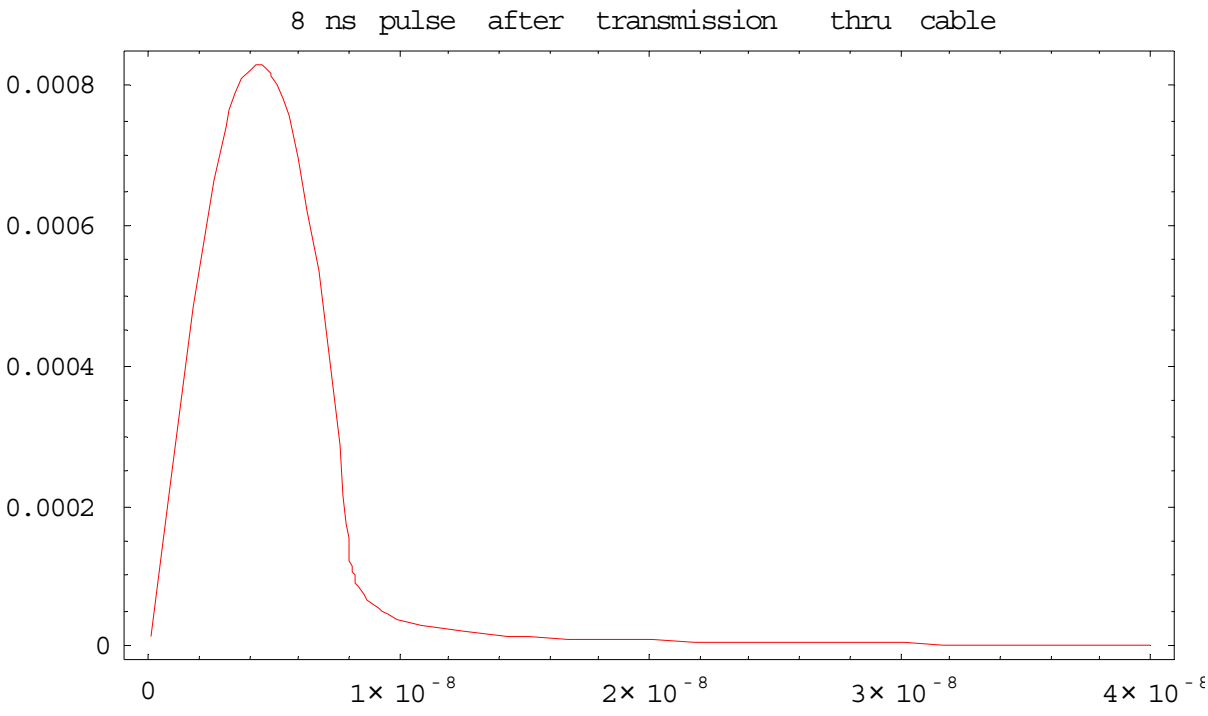
$$Ibeam = P + \overline{P} = P(1 + \frac{\overline{P}}{P})$$

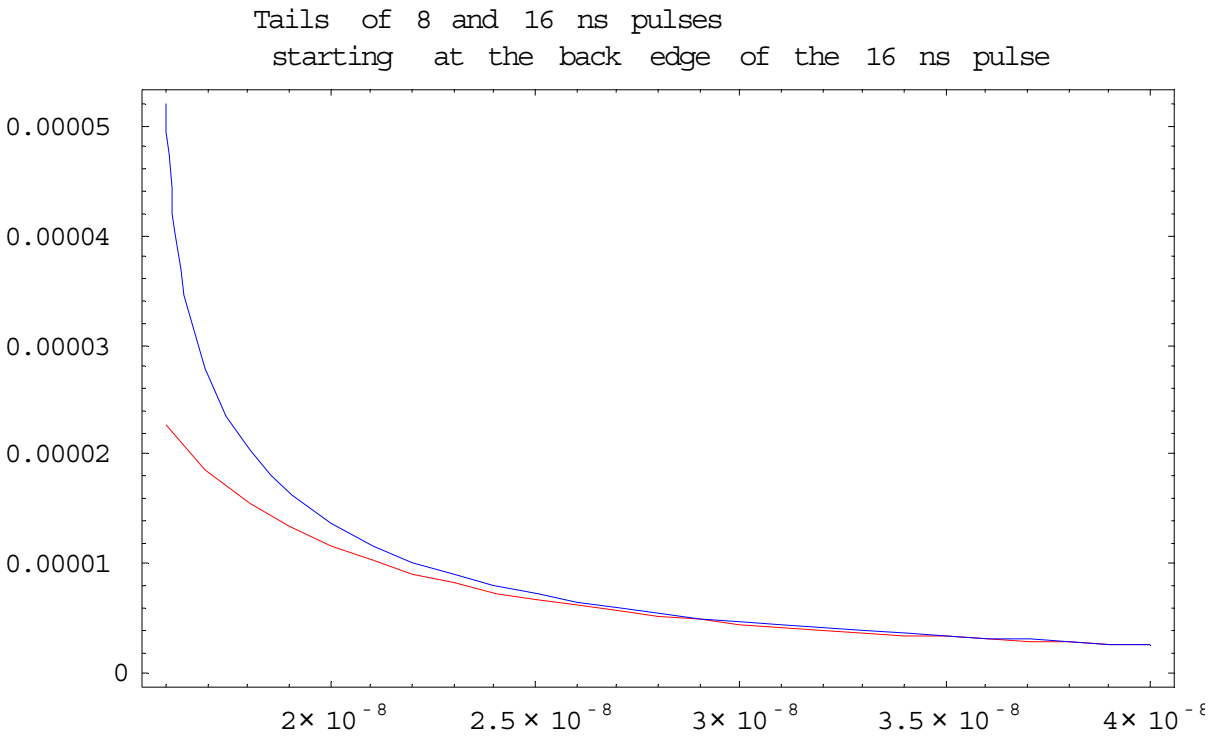
$$P = Ibeam/(1+r)$$

$$Pbar = r \times Ibeam/(1+r)$$

Suppose we are trying to calibrate the SBD. It has been set up as an absolute device where one measures the current in the machine by observing the voltage drop across a known resistor in the vacuum chamber wall. However, this requires an accurate measurement of the voltage by a sampling scope that is located upstairs. The approach here is to assume that Ibeam is the reference and to calibrate the SBD.

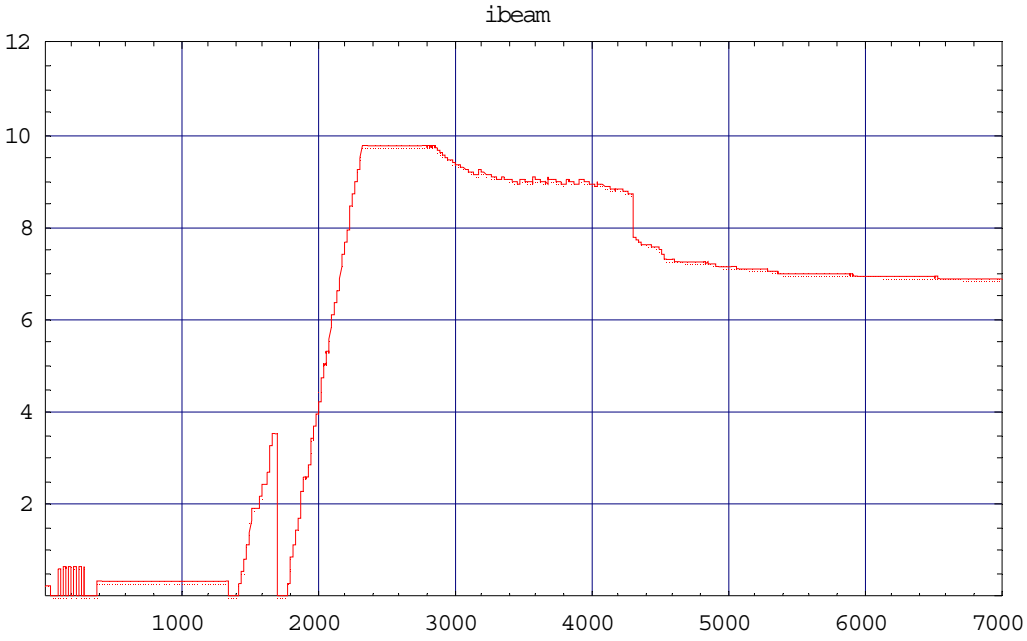
The measurement of the ratio r, of pbars to protons is about 0.10 to 0.15 and is not sensitive to dispersion in the cable. One can integrate the charge in one rf bucket for p and pbar. The tails are proportional to the charge and cancel in the ratio. The dispersion tails caused by the cable are at the several percent level as shown in the Fig. 1.


8 ns pulse after transmission thru cable
0.0008
0.0006
0.0004
0.0002
0
0
1× 10^-8
2× 10^-8
3× 10^-8
4× 10^-8

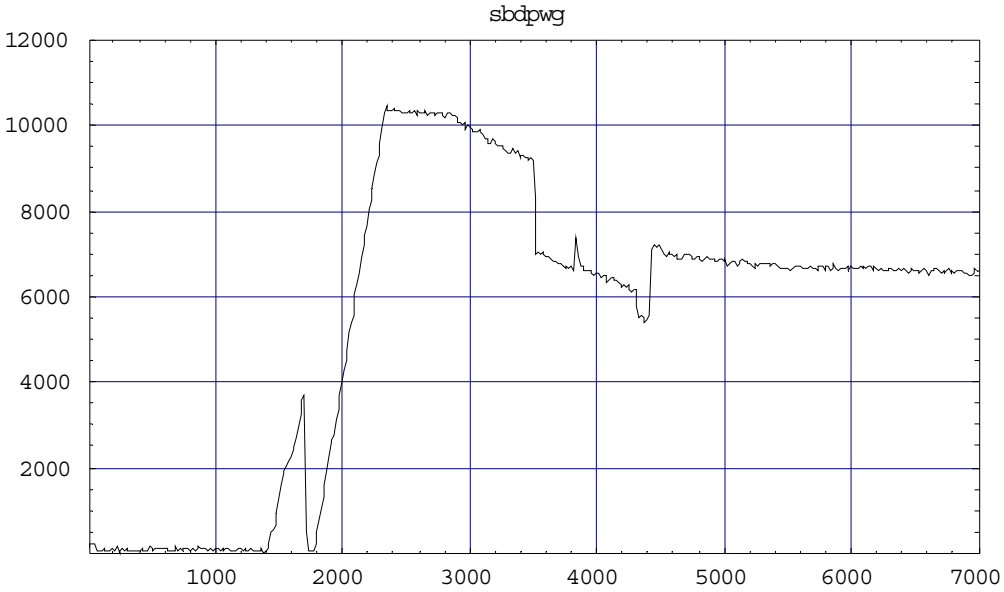

Tails of 8 and 16 ns pulses
starting at the back edge of the 16 ns pulse
0.00005
0.00004
0.00003
0.00002
0.00001
0
2× 10^-8
2.5 × 10^-8
3× 10^-8
3.5 × 10^-8
4× 10^-8

Lets try and calibrate the SBD using the above. The following are from Store 1961.

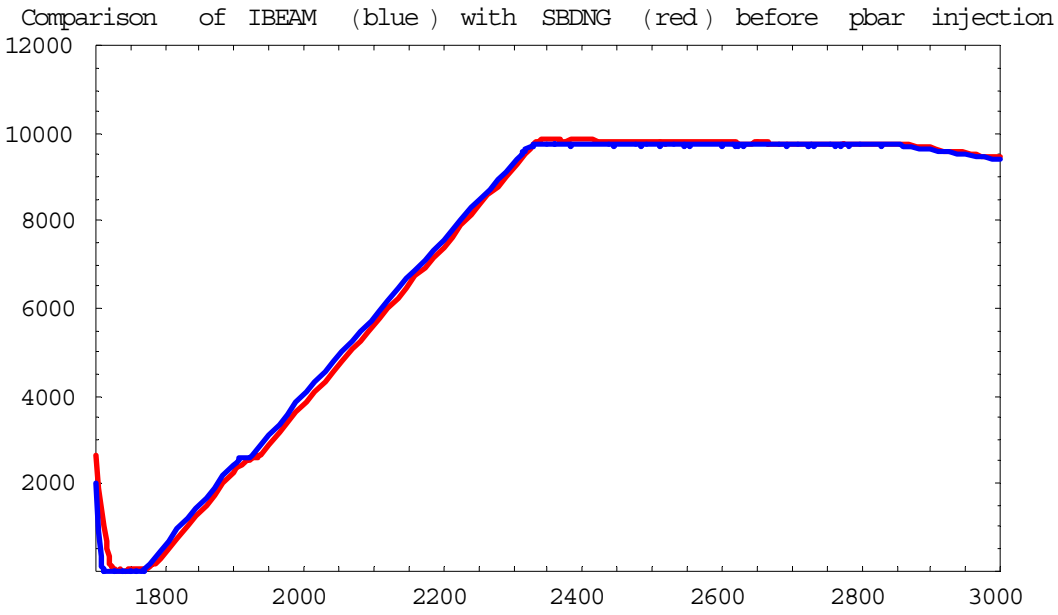
IBEAM



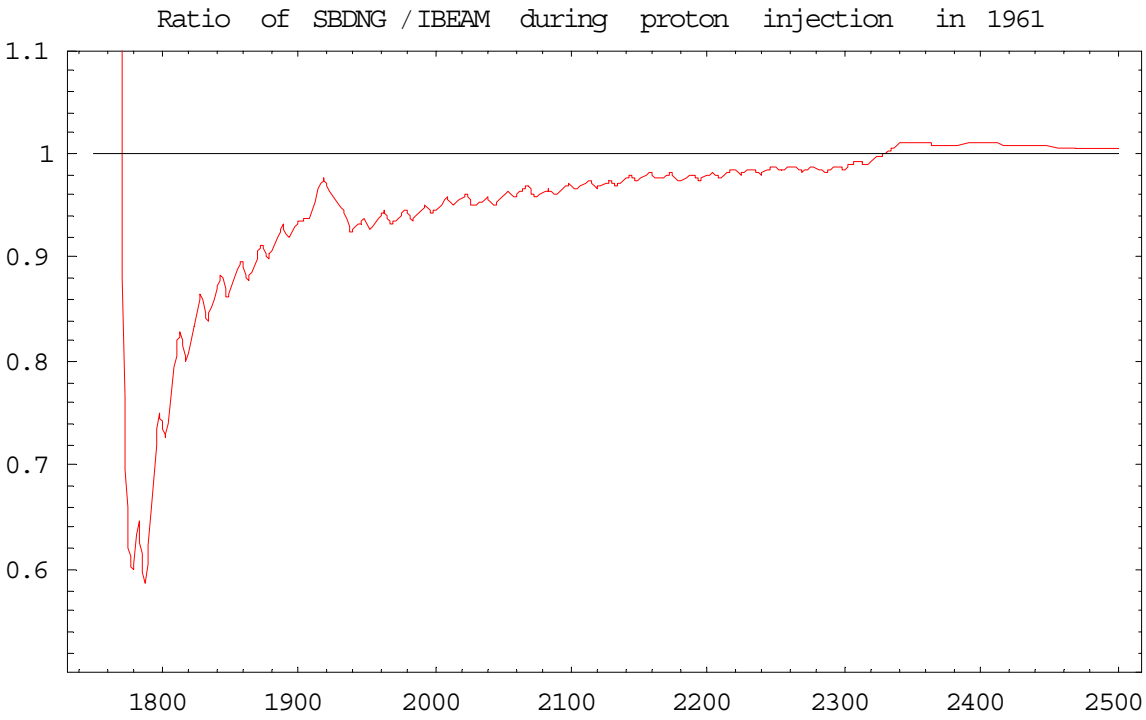
SBD protons WID:



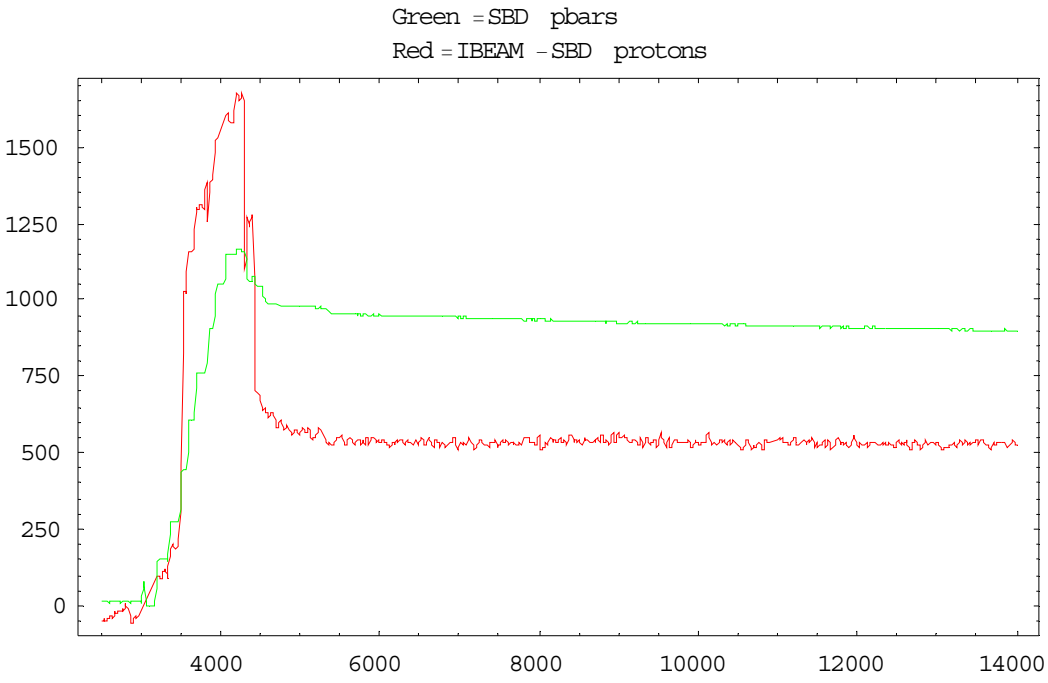
Protons at injection:



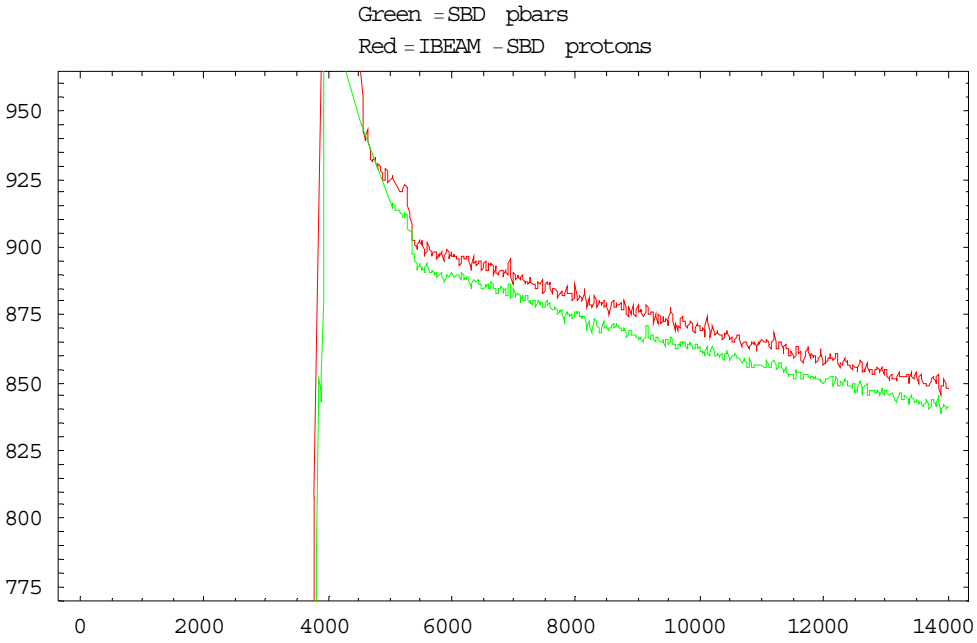
Ratio SBD protons / IBEAM There are no pbars yet! Good agreement. Calibration of SBD close to 1.00.



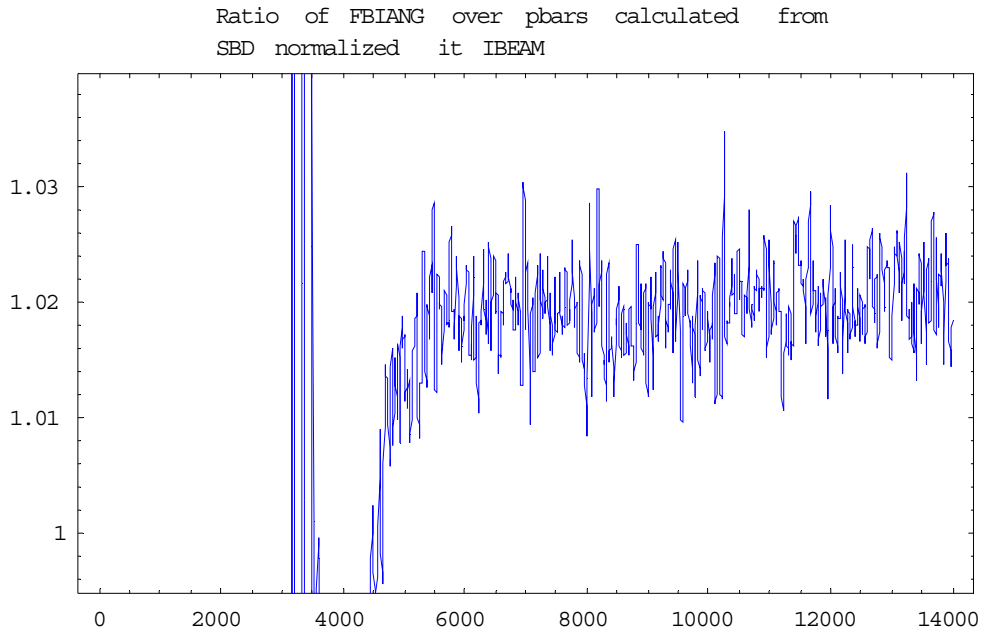
Check pbars= IBEAM – SBD Protons. TROUBLE!



This can be fixed by using a calibration constant of 0.936 for SBD as the following curve shows. But this will screw up early calibration at 150 GeV.



FBI can be calibrated using pbars from above Store 1961



Stores from 10-27 to 11-3 FBIANG / pbars calculated from SBD and Ibeam